

REMARKS

The Office Action dated June 1, 2004 has been received and carefully studied.

An RCE is filed herewith.

By the accompanying amendment, the claims have been amended to recite that it is the battery separator that has a useful life.

Applicants respectfully disagree with the Examiner's analysis of the limitation "for a lead-acid storage battery having a useful life". The "useful life" limitation (which has now been moved so as to modify the separator itself) is not an intended use; the intended use is in a lead-acid storage battery. Furthermore, the "useful life" limitation provides proper antecedent basis for the recitation in the body of the claims that the ribs and studs remain on the sheet during that useful life.

That the statement "for a lead-acid storage battery" is an intended use limitation does not alter Applicants' position that the skilled artisan would not be motivated to combine the teachings of Grimes et al. with those of Knauer, since Knauer relates to pocket separators for lead-acid storage batteries while Grimes et al. relate to separators for zinc-bromine batteries. This is the case regardless of the instant claim language, and is elaborated on below.

The Examiner newly rejects claims 1, 5, 7, 8, 11 and 12-14 under 35 U.S.C. §112, second paragraph, as being indefinite. By the accompanying amendment, the claims 1, 5, 12 and 13 have been

amended to refer back to the two to four vertical ribs rather than the at least one vertical rib. It is believed that the amendment overcomes the rejection.

The Examiner newly rejects claims 1, 5, 7 and 11-15 under 35 U.S.C. §103(a) as being unpatentable over Knauer, U.S. Patent No. 5,558,952 in view of Grimes, U.S. Patent No. 4,396,689, and further in view of Daramic II-V: Polyethylene battery separators for starter batteries. The Examiner states that Knauer teaches a pocket battery separator for retaining positive or negative electrode plates in an electric storage battery formed of a porous sheet that has a plurality of continuous vertical ribs, a plurality of broken inclined ribs at the side edges, and a plurality of broken vertical ribs in the center which engage the positive or negative plate in the pocket. The Examiner admits that Knauer does not disclose that the pocket separator has a plurality of studs on at least one side of the separator and two to four elongated vertical ribs in a center area of the at least one side, but cites Grimes as teaching these features in an electrochemical cell. The Daramic website is cited for teaching a microporous sheet material made of 100% vol. of a polyolefin.

The rejection is respectfully traversed.

Knauer (US 5,558,952) teaches pocket separators for lead acid storage batteries which do not show the disadvantages of the prior art, i.e. the disadvantages associated with vertical ribs, such as misalignment of electrode plates, impaired gas flow and slow

production (column 1, lines 27 to 42). According to Knauer these problems are solved by separators which comprise a plurality of continuous vertical ribs, a plurality of broken inclined ribs at the side edges, and a plurality of broken vertical ribs in the center which engage the positive or negative plate of the electrode (column 1, lines 53 to 57). Knauer expressly specifies that the vertical ribs are located at the side margins of the separator sheet (see Figures 1 to 3; column 2, lines 58 to 64; claim 1, column 4, lines 16 to 17). Knauer does not disclose separators having a plurality of studs and two to four elongated vertical ribs in the center area of one side of the separator.

According to Knauer misalignment is caused by the vertical ribs of the separator catching the edges of the electrode plates (column 1, lines 40 to 42). In the prior art considered by Knauer, the negative electrode plate is pocketed and then combined with positive electrode plates. Since separator ribs usually face the positive electrode plate in order to avoid a direct contact of the separator sheet with the highly oxidizing positive electrode, the ribs are located at the outside of the pocket and misalignment is observed when combining the pocketed negative plates with the positive plates. If, on the other hand, the positive electrode is pocketed, the ribs will be located on the inside of the pocket and misalignment will be observed during the pocketing step.

It follows that Knauer teaches away from the use of separators which are provided with vertical ribs in the center of the

separator sheet (column 1, lines 27 to 42).

Grimes et al. (US 4,396,689) describe separators for zinc-bromine batteries. Zinc-bromine batteries (column 2, lines 11 to 12) significantly differ from lead-acid batteries. As shown in Figure 1, zinc-bromine batteries comprise two separate compartments comprising two different electrolytes which are separately circulated through the battery (Figure 1 and column 4, lines 6 to 18). The two compartments of the battery are separated from each other by a separator membrane which prevents or hinders movements of anions from the cathode compartment to the anode compartment (column 4, lines 27 to 35). The separators are provided with projections which allow for an expeditious flow of electrolyte through the compartment (column 5, lines 26 to 28). Since both sides of the separator have to facilitate flow of electrolyte, both sides of the separator are provided with projections (Figures 7aa, 7bb, 7cc and 7dd). The projections on one web surface are directly opposite corresponding projections on the other web surface of the separator sheet in order to provide a greater structural integrity to the sheet (column 2, lines 49 to 53; column 5, lines 13 to 15). The separator design of Grimes et al. results in separators having great stiffness, which are difficult if not impossible to form into pockets. Grimes et al. do not disclose separators which are provided with projections on only one side of the separator sheet.

The separator membranes are inserted into non-porous frames

(col. 5, lines 1-4 and 35-39; Figure 6) which further increase the stiffness of the separators and make pocket formation even more difficult. In addition, due to the intended framing of the separator membranes the vertical ribs in Figure 7c do not extend to the edges of the separator sheet and leave a border without ribs. The separators of Grimes et al. are thus not compatible with the pocket design of Knauer and, therefore, a skilled artisan would not have combined the teachings of Grimes and Knauer.

Furthermore, zinc-bromine batteries - if used in the automotive industry at all - are intended to be used as vehicle propulsion battery (traction battery) e.g. in electric cars. The requirements of such batteries are completely different from the requirements to lead acid batteries which are used as starter batteries for cars. Zinc-bromine batteries cannot provide fast cold start properties which are needed to start a car since zinc-bromine batteries must first be activated by circulating the electrolyte before they can provide electric energy. Grimes et al. do not mention lead acid batteries at all and do not suggest that the separators disclosed therein may be used in lead acid batteries. Again, a skilled person would not have been motivated to combine the teachings of Knauer and Grimes et al. for this reason as well.

By the accompanying amendment, claims 1, 13 and 14 have been amended to recite that the plurality of studs and the two to four vertical ribs are provided on only one side of the separator

sheet. Support for the amendment can be found on page 5, third paragraph, of the specification as filed.

Assuming without conceding that a skilled artisan somehow would have been motivated to combined the teachings of Knauer and Grimes et al., he would not have arrived at separators according to the amended claims, but rather at separators comprising projections at both sides of the separator sheet.


In addition, without the benefit of the present invention, a skilled artisan would have selected a separator design which is compatible with the object of Knauer to avoid the disadvantages associated with vertical ribs in the center area of a separator sheet. Thus, a skilled artisan would have selected the separator design as shown in Figure 7b of Grimes et al. which greatly resembles the separator design as suggested by Knauer. A skilled artisan would certainly not have selected the design shown in Figure 7c, since Knauer explicitly indicates this design to be disadvantageous. Combining the separator design of Figure 7c of Grimes et al. with the teaching of Knauer is clearly based on hindsight and ignores Knauer's intention to avoid the disadvantages associated with vertical ribs. Consequently, a combination of Grimes et al. and Knauer cannot render the separators of the present invention obvious.

The Daramic reference does not supply any of the aforementioned deficiencies of the Knauer/Grimes combination.

The allowability of claim 8 is noted with appreciation.

Reconsideration and allowance are respectfully requested in view of the foregoing amendment and remarks.

Respectfully submitted,


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